

REMARKS

In the latest Office Action, claims 1, 2, 4, 10, 17, 18, 22, 24, and 25 were rejected under 35 U.S.C. 103(a) as being unpatentable over Murachi et al. (U.S. 5,746,989) in view of Deeba et al. (newly cited, U.S. 6,375,910). Deeba et al. teach a multi-zoned catalytic trap for the reduction of NO<sub>x</sub> in an exhaust gas stream at a temperature of from about 250°C to 350°C. The catalyst trap comprises a metal oxide support containing a palladium, platinum or rhodium catalyst and an NO<sub>x</sub> sorbent comprising an alkaline earth metal.

The Examiner asserts that Deeba teaches that "it is conventional in the art" to use an oxidation catalyst comprising platinum on a support material of zirconia-silica and a conversion temperature of between 79°C to 204°C, referring to col. 3, lines 8-17. However, applicants note that col. 3 does not refer to the teachings of Deeba, but rather to the teachings of Campbell et al., U.S. Patent No. 5,451,558 (copy enclosed). Campbell et al. teach a method of decreasing levels of pollutants such as NO<sub>x</sub> in a gas turbine. Campbell et al. teach that oxidation preferably occurs at temperatures ranging from 175°F to 400°F (79°C to 204°C) where the oxidation catalyst preferably comprises platinum supported on alumina. See col. 4, lines 14-15. While Campbell et al. teach that the support may comprise a number of other oxides including zirconia or silica, there is no specific teaching in Campbell et al. of using a catalyst comprising platinum and a support comprising zirconia-silica for the purpose of converting NO to NO<sub>2</sub>.

Nor do Campbell et al. recognize that a zirconia-silica support has strong acidic properties. As previously pointed out, the use of a zirconia-silica support provides a significant enhancement in low temperature activity and thermal stability compared with other catalysts prepared on silica or zirconia **alone**. See the specification at page 4, lines 15-22. See also the specification at page 11, lines 14-15 in which applicants state their belief that the increased activity of the catalyst is linked to the additional acidity

provided by the zirconia-silica support material.

Nor do Campbell et al. teach or suggest a method of making a zirconia-stabilized silica support. See the specification at page 4, lines 25-28 and new claim 29.

Applicants further note that Campbell et al. do not teach or suggest the claimed catalyst for use in a diesel exhaust gas treatment system as claimed, but rather are concerned with removal of pollutants from a turbine in a power generating stack.

Applicants also wish to point out that the catalyst compositions of both Deeba and Campbell differ significantly from that of the present invention. As taught in the present invention at page 4, lines 29-34 and page 5, 1-5, the activity of the claimed catalyst increases with the use of a highly acidic support having strong acid sites, i.e., zirconia-stabilized silica, with or without additional acidic components (see also amended claims 1, 10, and 24-26). Also as taught in the present invention, the resulting catalyst has a pKa of between about 5 to 13. See the specification at page 5, lines 4-5 and new claim 27. The use of such an acidic supporting phase functions to increase NO **desorption**. See the specification at page 11, lines 14-18.

In contrast, the catalyst compositions of Deeba and Campbell function to increase NO **adsorption** as they utilize a combined catalyst/absorber, i.e., they include the use of **highly basic** NO<sub>x</sub> adsorption components such as alkali and alkaline earth carbonates, alkaline earth metals, or oxygenated compounds of alkali metals (see Deeba et al., col. 5, and Campbell et al., col. 3, lines 17-22). Neither Deeba et al. nor Campbell et al. teach or suggest a desire for a highly acidic support, but rather desire a support having refractory characteristics, i.e., chemical inertness and surface-area stability after high-temperature exposure. Applicants teach the use of support phases which are both refractory and acidic, and as such, teach away from the use of well-known basic oxides, such as Mg, Ca, and La. See the specification at page 11, lines 12-13. As described in Example 1, it is clear that the use of such oxides (which are taught by Deeba et al. and Campbell et al.) have a detrimental effect on the activity of

the catalyst.

Applicants further note that Deeba et al. teach away from the use of silica in any of the layers and/or zones of their catalytic trap (see col. 8, lines 42-46 and claims 18-19, 27-28 and 47-48).

Deeba et al. and Campbell are concerned primarily with the **adsorption** of NO<sub>x</sub>, while applicants are concerned with increasing NO and NO<sub>2</sub> **desorption** to facilitate NO oxidation. Further, neither Deeba nor Campbell present any data relating to the efficiency of NO conversion to NO<sub>2</sub>. As taught in the present invention and as recited in claim 17 and new claim 28, the method of the present invention results in a conversion of about 60 to 96% of NO to NO<sub>2</sub>.

Accordingly, one skilled in the art would not have looked to the trap or absorber materials of Deeba or Campbell to provide the NO<sub>x</sub> oxidation activity shown by the present invention. Claims 1, 2, 4, 10, 17, 18, 22, 24, and 25 as amended, and new claims 27-29 are clearly patentable over Deeba et al. (and Campbell et al.)

Claim 3 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Murachi et al. in view of Deeba et al. and further in view of Manson (U.S. 6,248,689). The Examiner asserts that the "modified Murachi system" fails to disclose an oxidation catalyst being combined with a particulate filter as recited in claim 3, but asserts that Manson teaches that it is conventional in the art to use an oxidation catalyst with a particulate filter. However, neither Murachi et al., Deeba et al. nor Manson et al. teach or suggest using the claimed combination of a platinum catalyst on a zirconia-silica support. Nor do any of the references recognize the advantages of using a platinum catalyst on a zirconia-silica support, i.e., an increase in activity/NO conversion. As previously pointed out, Manson teaches a number of different suitable support materials including the use of silica and zirconia **alone**, which is in contrast to the teaching of the present invention. And, as pointed out above, Deeba et al. and Campbell et al. require the use of adsorbent materials.

Claims 5 and 19 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Murachi et al. in view of Deeba et al. and further in view of Andreasson et al. (WO 99/39809). The Examiner asserts that it would have been obvious to use a second, selective reduction catalyst as taught by Andreasson in the "modified Murachi system." However, as previously pointed out, there is no motivation to modify Murachi et al. as none of the cited references teach or suggest an oxidation catalyst comprising platinum on a zirconia-silica support, nor do they teach or suggest the conversion of NO to NO<sub>2</sub> using such an oxidation catalyst.

Claims 6 and 20 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Murachi et al. in view of Deeba et al. and further in view of Khair et al. (U.S. Patent No. 6,293,096). The Examiner maintains that it would have been obvious to use an NO<sub>x</sub> trap as taught by Khair et al. in the "modified Murachi system". Again, none of the references teach or suggest an oxidation catalyst comprising platinum on a zirconia-silica support as recited in claims 1 and 10, from which claims 6 and 20 depend. And, as pointed out above, there is no motivation to combine the teachings of the references.

Claims 7 and 11 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Murachi et al. in view of Deeba et al. and further in view of design choice. The Examiner acknowledges that neither Murachi et al. nor Deeba et al. teach the claimed amounts of platinum, zirconia, and silica, but reasons that the claimed ranges would have been an obvious matter of design choice. Applicants disagree. As neither Murachi et al. nor Deeba et al. teach or suggest using the specific combination of platinum on a zirconia-silica support for the purpose of converting NO to NO<sub>2</sub>, it is not believed that the amounts of the components of the oxidation catalyst would have been obvious.

Claims 8, 9, 15 and 16 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Murachi et al. in view of Deeba et al. and further in view of

Yoshimoto et al. (JP 02-056250). The Examiner has cited Yoshimoto et al. for teaching a method of forming oxides on a catalyst carrier which may include the use of  $\text{TiO}_2$ ,  $\text{WO}_3$ , and a heteropolyacid. However, there is no teaching or suggestion in either Yoshimoto or Deeba et al. of adding oxides or heteropolyacids to an oxidation catalyst comprising platinum on a **zirconia-silica** support as taught in the present invention. Rather, Yoshimoto teaches a support comprising a  $\text{TiO}_x$  metal oxide in combination with  $\text{WO}_3$ ,  $\text{Al}_2\text{O}_3$ , etc. Nor do Yoshimoto et al. nor any of the other references recognize that the activity of the claimed catalyst is increased by the addition of a heteropolyacid. There is clearly no motivation to use the acidic components of Yoshimoto et al. with the catalyst of Murachi et al. or Deeba et al.

Claims 12-14 and 23 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Murachi et al. in view of Deeba et al. and further in view of Cooper et al. (U.S. 4,902,487) and design choice. While the Examiner acknowledges that neither Murachi et al. nor Manson teaches the claimed pretreatment of the catalyst, he asserts that it would have been obvious to do so in view of Cooper et al., who teach the use of  $\text{NO}_2$  to combust particulate on a filter using a catalyst such as platinum, palladium, etc. However, as previously pointed out, Cooper does not teach or suggest that the treatment is carried out at a temperature between about 500 to 650°C as recited in claim 14. And, as none of the references teach or suggest the combination of a platinum catalyst on a zirconia-silica support, there is clearly no motivation to combine the teachings of the references.

Claim 26 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Twigg et al. (U.S. 6,294,141) in view of Deeba et al. The Examiner asserts that it would have been obvious to use the oxidation catalyst of Deeba et al. as the first oxidation catalyst in Twigg et al. First, neither Deeba et al. (nor Campbell et al.) teach the claimed oxidation catalyst. Second, the Examiner has provided no substantive reasoning as to why one skilled in the art would be motivated to make such a

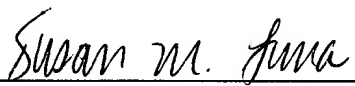
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substitution. Twigg et al. specifically teaches that the first catalyst should be supported on a **metal** monolith, not a ceramic support as claimed.

For all of the above reasons, applicants submit that claims 1-20 and 22-26, as amended, and new claims 27-29 are patentable over the cited references. Early notification of allowable subject matter is respectfully requested.

Respectfully submitted,

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